LimnoTech
Water | Environment | Scientists | Engineers

MEMORANDUM

FROM: John Wolfe

TO: Bruce Fidler, The Louis Berger Group

DATE: December 13, 2010

PROJECT: HUDNEW2

CC: Benny Conetta and
Eugenia Naranjo, U.S. EPA

SUBJECT: Status of Upper Hudson River Model Evaluation

The purpose of this memo is to report on the status of our evaluation of General Electric's Upper Hudson River Modeling System, which was developed by Anchor QEA (AQ). Based on our review of documents and initial discussions with AQ, we have previously identified issues with each of the component models (hydrodynamic and sediment transport, PCB fate, and bioaccumulation models), and have provided U.S. EPA with documentation of those issues in a memorandum, drafted in October 2010 and finalized with today's date.

In October, the U.S. EPA model evaluation team and AQ initiated a series of weekly WebEx teleconferences focused on the baseline model (i.e. the model of the river under pre-dredge conditions), beginning with hydrodynamics and sediment transport. After a series of those calls through late October and early November, the two parties agreed to form teams, working collaboratively on

- setting objectives for the model,
- metrics to determine its reliability,
- framework issues to pursue, and
- model development tasks that could enhance performance.

The teams worked through November and early December to bring intermediate work products to a meeting that was held December 7-8 at AQ's offices in Montvale NJ. In those two days of meetings, each team presented its findings for group discussion and evaluation. A set of action items from that meeting is provided as Attachment 1, with my annotations inserted into the document. At that meeting, agreements were reached on paths forward as shown in the attached. The teams will pursue these action items with the goal of reporting progress at our next face-to-face meeting, currently scheduled for January 18-19 in Ann Arbor. Additional working groups will also be formed this week to address issues with the PCB fate model, in preparation for discussion of that model at the January meetings. We anticipate that all of the issues on which we have briefed U.S. EPA with respect to the PCB fate model will be on the agenda for the January meeting.

We believe that the collaborative process offers promise of improvements to the Upper Hudson River Modeling System insofar as it is being considered as the basis for a remedial management tool.

501 Avis Drive
Ann Arbor, MI 48108
734-332-1200
Fax: 734-332-1212
www.limno.com

Attachment 1: Annotated December 7-8th Meeting Action Items

Topic 1 – Objectives

JRW Comment: The group agreed to a set of objectives similar to those in the Model Evaluation Plan that LimnoTech and its partners drafted for EPA. The exception was that AQ thought it would not be practical to use the model to respond in a few hours to alarms about exceedences, and wants to explore using the model to develop simpler tools, such as steady state runs to be kept on the shelf, showing how releases are related to flows, dredging rates, and other factors.

- What is the form of the Operational Model? – Jen Benaman

Topic 2 – Predictive Capabilities

JRW Comment: The June 2002 AQ modeling report focuses on short-term flood events to test the sediment transport model. The working group has broadened the list of metrics. This includes giving more emphasis on the ability of the model to make accurate long-term predictions, under MNA and remedial alternatives.

- PCB Data Inventory – Jen Benaman
- TSS Data Inventory
- Sedtran - Short Term:
    - April 1994 flood event
        - Characterize uncertainty
    - 1993 & 1997 flood events

- Sedtran - Long Term:
    - Bathymetry comparisons (assess +/- error):
        - 1991 → 2005/06 – Find existing comparisons
        - 1991 → 2001
        - Cs-137 cores (very limited spatial coverage)
            - Find initial analysis of core data
    - Mass balance (@ TID, Stillwater, Waterford)
    - Evaluate TSS concentrations (@ TID, Lock 5, Stillwater, Waterford):

        - 1977-2003
        - 2004-2008

    - Predicted cohesive & non-cohesive bed composition (1977-2005 period)
        - Locate 1977 data and evaluate quality

- <u>ChemFate – Short Term (Combined Solids and PCB comparisons):</u>
    - Jan. 1998 flood event (peak PCB conc. measured)
    - Sept. 1991 PCB release event (?)
    - July 2006 Flood

- <u>ChemFate – Long Term (Combined Solids and PCB comparisons):</u>
    - Comparison to predicted water column PCB conc. vs. data (2004-08)
        - Look for longest possible consistent time series to evaluate effect on Sedtran on recovery rates
    - Cumulative mass loadings @ key locations:
        - TID (?)
        - Stillwater
        - Waterford
    - Sediment PCB concentration targets:
        - Challenges with various datasets (analytical techniques, spatial scale, etc.)
- Construct a Table that summarizes all metrics
    - Dataset, Model run, Comparison Results

Topic 3 – Model Structure

JRW Comment: AQ has agreed to test a model with more realistic sediment layering (Approach 1), in parallel with a recalibration of its current structure (Approach 2). The parallel approach is to ensure there is a fall-back if the new approach has insurmountable problems. The importance of leaving out bed load will also be evaluated by "turning it on" in the current model and seeing how important it appears to be, relative to suspended load.

- Critical shear stress based on particle effective diameter of each class
- Bedload Evaluation
    - Use the existing bedload model to assess the importance of bedload on the transport of sediments and estimate PCB mass fluxes. Investigate more sediment classes for bedload as needed.
- Pursue 2 Approaches in parallel both subject to model development changes considered in Topic 4
    - Approach 1
        - Layered bed model
            - Constant thickness surface layer
        - Dynamic d50
            - Tied to bed properties spatial distribution – Topic 4
        - Use 1D model to do initial testing of layer and Dynamic d50 behavior
    - Approach 2
        - Maintain current structure

Topic 4 – Model Development

JRW Comment: The working group is developing several improved inputs. 1. Sediment types will be changed to better match site data. Currently two of the four types do not 2. The model currently uses hydrodynamics rather than sediment data to set bed conditions (e.g. grain sizes) and the working group is piloting two methods based on data. 3. The solids load coming into the model from upstream and tributaries is currently too simple (silt vs. sand composition doesn't vary with flow) and a method is being tested to improve that.

- Sediment Class Definition
    - Use new binning to define classes
- Spatial distribution of D50: 2 Approaches
    - Use Shear stress correlation
        - Probably only option R5 and below
        - Hybrid approach: use data and probing qualitatively to correct the shear stress based predictions
    - Use Bulk density correlation
        - Explore how to overcome the issue of predicting smaller d50 on the top 2 inches
            - Substitute real data where it exists
            - Correct (scale) predicted d50 by correcting the top 2 inches bulk density
        - Compare AQ and LTI sediment database
- Spatial Distribution of Composition for Non-Cohesive
    - Non-cohesive
        - Finalize proposed approach
    - Cohesive
        - Do bounding calculations of the impact of bed composition on model results (sediment and PCB fluxes)
- Incoming Sediment Load Composition
    - Finalize proposed approach